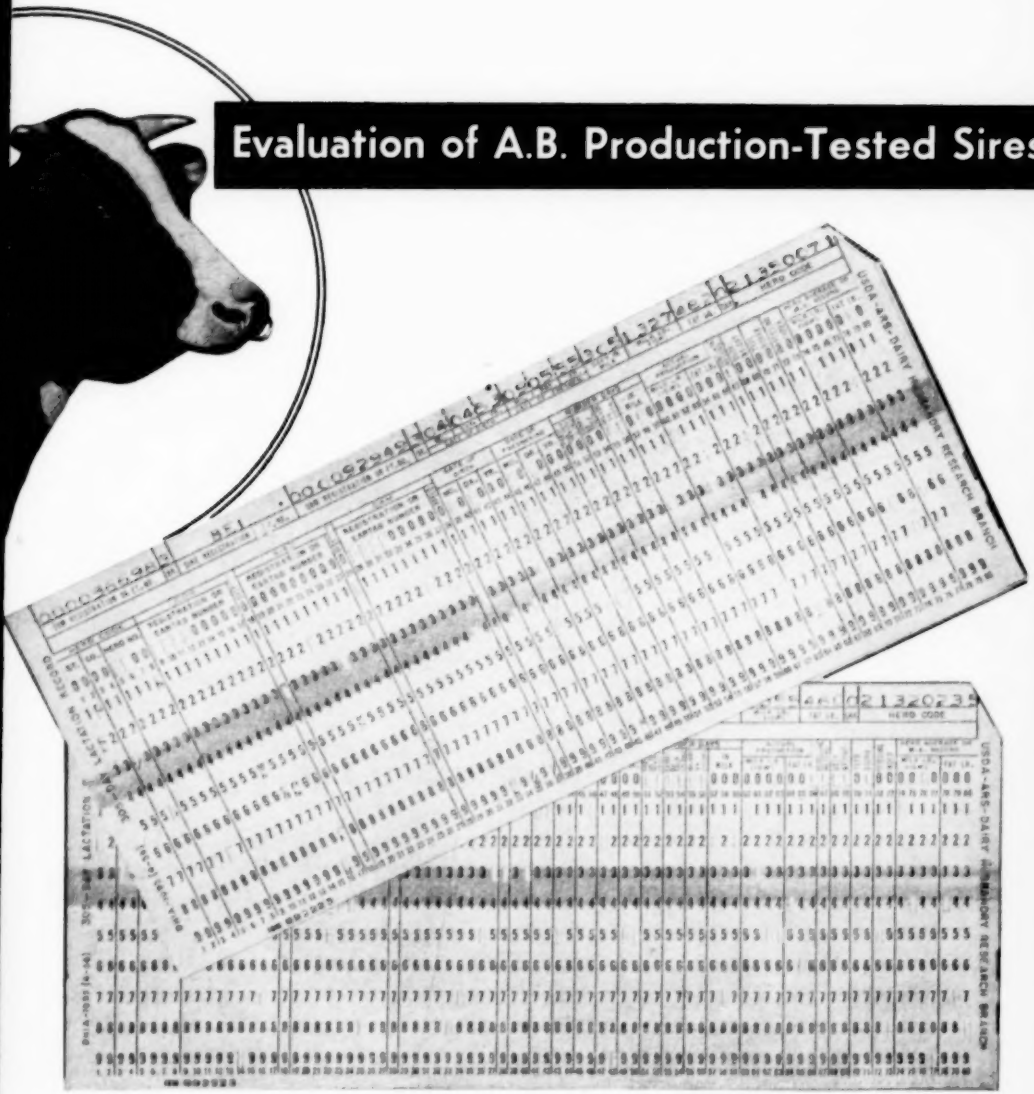
CORNELL EXTENSION BULLETIN 999

Evaluation of A.B. Production-Tested Sires



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Foreword

This leaflet is compiled to show the various environmental influences that affect the production of artificially sired cows. To measure the transmitting ability of AB sires, their daughters' records must be adjusted for:

1. Age
2. Times milked per day (2 times milking standard)
3. Length of lactation (305-day standard)
4. Year of freshening
5. Season of freshening
6. Herd in which record is made

Abbreviations Used

AB—Artificial Breeding

NYABC—New York Artificial Breeders' Coop., Inc.

DHIC—Dairy Herd Improvement Cooperative

USDA—United States Department of Agriculture

M.E.—Mature Equivalent

This bulletin was prepared by R. W. Spalding, Wilmot Carter and C. R. Henderson, with helpful suggestions from other members of the Department of Animal Husbandry at Cornell University.

In Brief

1. During 1957, one out of every four cows in the United States will be artificially inseminated. New York breeds even a higher percentage of their dairy-cow population by artificial insemination.
2. The industry is maintaining a 70 percent non-return rate (60 to-90-day basis), which compares favorably with natural service.
3. An AB bull may sire 20,000 progeny each year, and more than 100,000 in a lifetime, with present techniques.
4. To evaluate AB sires, records should be adjusted for times milked, length of lactation, age of cow, year and season of freshening, and herd environment.
5. Bulls differ greatly in their transmitting abilities. An AB proof can distinguish these differences more accurately than can a natural service proof.
6. The best test of a bull's value for artificial insemination is the performance of 50 or more of his daughters from artificial insemination.
7. Several times as many bulls as will eventually be needed must be sampled in order to make the greatest progress.
8. A good sampling program can be carried on with only 10 to 20 percent of the total breedings to young sires.
9. Bulls placed in artificial insemination service at five to seven years of age are dead or have little useful service left when their AB proofs are available. Therefore, young bulls should be selected in order to have usable AB production-tested sires for the future.
10. Sons of the best AB production-tested bulls are the most reliable young bulls to sample.

Evaluation of AB Production-Tested Sires

THE artificial insemination program has made phenomenal growth in New York State since its beginning in November 1938. Starting with 697 first services the first year, it has grown to 437,306 cows in 1956 as shown in figure 1.

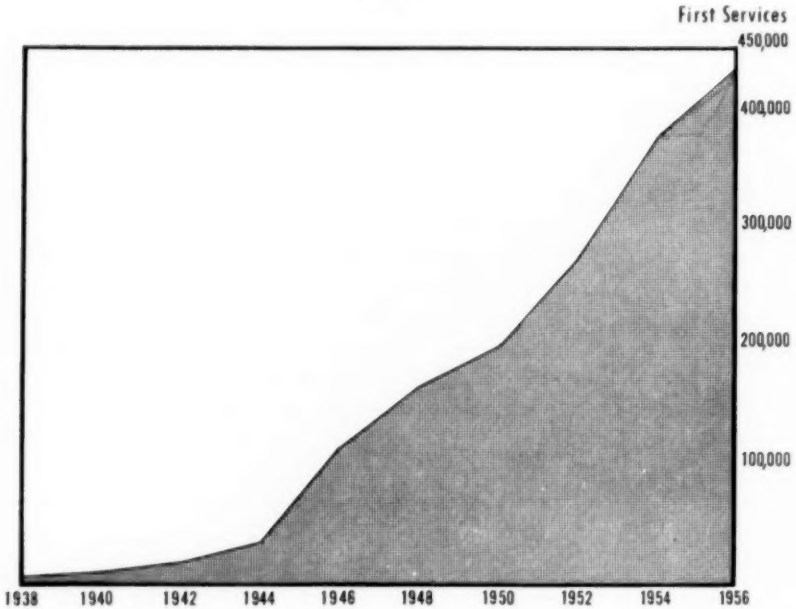
About 6,000,000 cows will be bred artificially this year in the United States, about 25 percent of the dairy-cow population. In New York, 30 percent of the dairy cows are being artificially inseminated.

Breeding efficiency

The AB industry, as a whole, has maintained approximately a 70 percent conception rate (60- to 90-day non-returns) for the past five years. This compares favorably with natural service.

Spread of vibrio foetus and some other reproductive infections are controlled by artificial insemination when antibiotics are properly used in the semen.

Figure 1



Production results

The production of artificially sired cows determines the success or failure of any AB program. The production of these cows must be studied closely and every effort made to use only the

best sires. Research on semen production and utilization has made it possible for a bull to sire 20,000 progeny each year, and even this may be increased by new research developments. One sire at NYABC has more than 100,000 probable conceptions during a seven-year period.

With bulls siring this number of daughters, it is important that every bull chosen is a herd-improving sire. Research at Cornell has shown that production information based on many of his AB progeny is a reliable indicator of the true transmitting ability of an AB sire.

What is an AB production-tested sire?

An AB production-tested sire has 25 or more production-tested daughters that were conceived by artificial insemination. These records are made in many herds in DHI under different environmental conditions.

It is now possible to evaluate the transmitting abilities of these sires more accurately than in the past through the adjustment of records for times milked, length of lactation, and age, as well as for environment.

A comparison of natural service proofs and AB proofs of the same sires

The proof of a sire is his influence on the cow population to which he is mated. To test the different methods of selecting sires for use in artificial insemination, their natural service daughters should be compared with the production of a large number of their AB sired daughters.

A study was conducted at Cornell comparing the production of natural service daughters of sires with the production of their daughters resulting from artificial breeding. Various methods of utilizing the natural service proofs were tried, and the results of these different methods are shown in table 1.

Table 1. Fraction of superiority of natural service proof repeated in AB proof

Information in natural service proof	Fraction of superiority repeated in AB proof
Daughters' average production	.00
Daughters' average production minus dams' average	.20
Equal parent index	.19
Daughters' average production minus average of stablemates	.20
Daughters' average production minus dams' average adjusted for number of records per dam	.26

The study shows that the production of the natural service daughters of a sire when compared with either the production of their dams or their stablemates is of some value in predicting the production of the AB daughters of a group of bulls. The table, however, indicates that this information would be of little value in predicting the production of an individual sire's AB daughters.

Research was done at Cornell comparing the production of the first AB daughters of bulls with their later AB daughters. These results are presented in table 2.

Table 2. Fraction of superiority of first AB proof repeated in production of later AB daughters

Number of daughters in first AB proof	Fraction of superiority repeated in later AB daughters
10	.46
20	.63
50	.81
500	.98

This study also shows that the first AB daughters of a sire is a better indication of the production of his future AB daughters than was any of the natural proof information used in this study. The production information on the first 50 daughters of a sire, although not perfect, is a very reliable indication of what his future AB daughters will produce.

Times milked per day

When cows are milked more frequently than twice a day (2×), they give more milk per day but less per milking. To adjust from three times to two times milking, multiply the 3× record by 0.83.

2X Milking

3X Milking

Length of lactation

Most dairymen attempt to breed their cows to have them calve every twelve months. The ideal is to milk the cow for ten months (305 days), then allow her two months' rest (dry period) to build up her body reserves for her next lactation.

Giving the cow only one month of rest, that is milking her 335 days, increases production in that lactation but decreases it in the next if she calves back in 12 months. Delay in breeding the cow so she calves again in fifteen months instead of twelve greatly increases the size of the lactation, but probably decreases the lifetime production of the cow.

To change a 365-day record to a 305-day basis, multiply the 365-day record by 0.85.

Age

As cows mature, they produce more because of increased size and greater mammary development. Well-grown heifers usually produce more than poorly grown ones that must use nutrients to grow as well as to produce milk. The increase in production with age for the Jersey and Holstein breeds, based on New York DHIC tested cows is shown in figure 2. Mature Jersey cows produced their maximum (398 pounds of fat) at six years of age. Two-year-old Jerseys averaged 303 pounds of fat; (398÷303= 1.31). That is the factor by which to multiply a two-year-old Jersey's record to put it on a mature-equivalent (M.E.) basis.

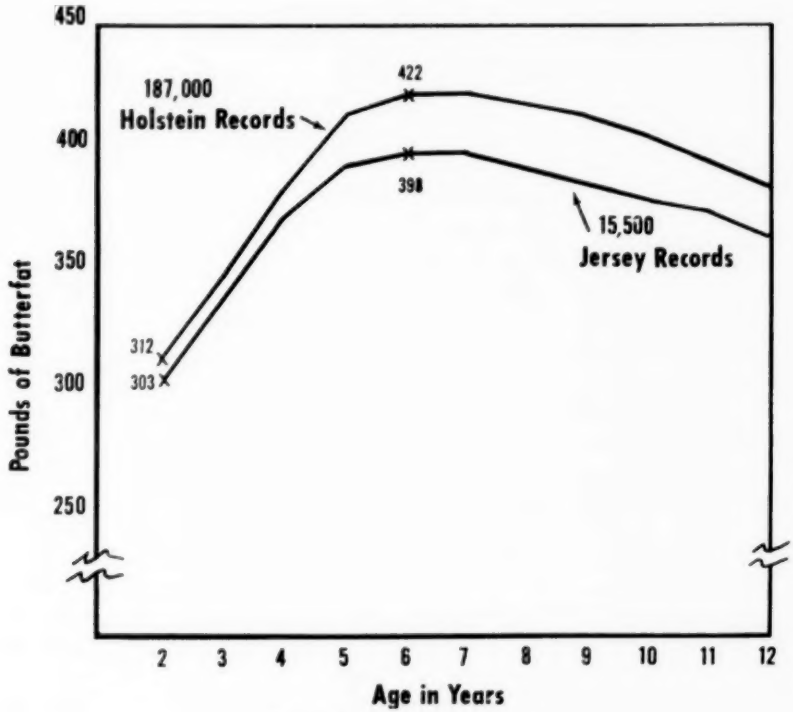


Figure 2. Actual production

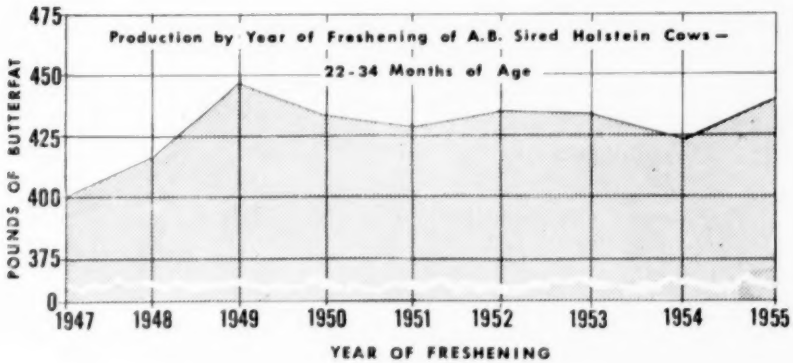


Figure 3

Year of freshening

Does a herd give the same production year after year? Most dairymen get more milk in the years they have good early-cut hay to feed than when they have over-mature, late-cut hay available.

Fluctuation in Holstein production in New York DHI herds for the past eight years is shown in figure 3.

Season of freshening

For years, the USDA has reported that cows freshening in the fall produce more milk than those freshening in the spring. The amount of this fluctuation with New York AB-sired Holstein cows is given in figure 4.

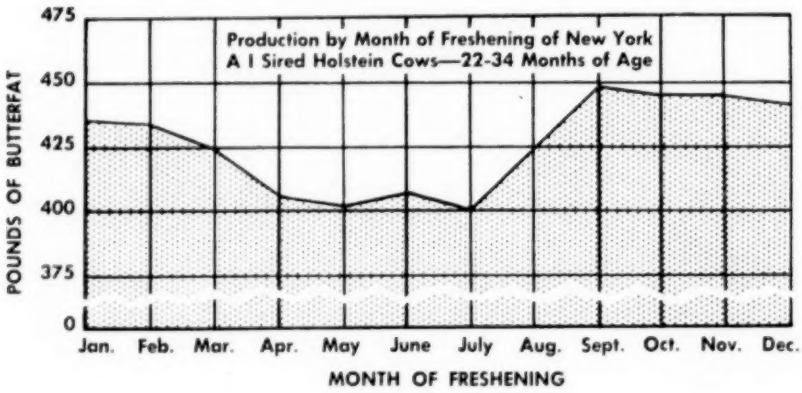
Herd environment in which record is made

Production data have shown that certain AB bulls tend to be used in herds with higher or lower production levels than the average of the breed. This may be due to chance or to popularity differences of the sires. There are wide differences in the production levels by areas as well as by herds within areas. Research has shown that 90 percent of the difference between herd-production levels is reflected in the production of a sire's daughters. To evaluate AB sires, this fact must be taken into consideration.

Adjusting records for environmental influences

Cows differ in their production due to season of freshening and the kind and amount of feed they receive. Since exact feeding and management information is not available, these differences can best be corrected by making comparisons between the production of animals having the same opportunity; that is, cows that freshened during the same season of the year, stood in the same barn, ate feed from the same source, and were milked similarly. In

Figure 4



other words, it is as important to know whether a cow produces more or less than other cows in the same herd having the same opportunity as it is to know whether she produces 400 or 500 pounds of butterfat in a lactation.

Example of how to evaluate an AB production-tested sire

The daughters of a sire are first compared with their stablemates.

What are stablemates? They are all the cows in a herd that freshen during the same year and season as the daughter of the bull being studied.

Figure 5 shows a comparison between Ocapok's daughters and their stablemates.

430 pounds of fat — 417 = 13 pounds which is the amount by which the stablemates are below the breed average.

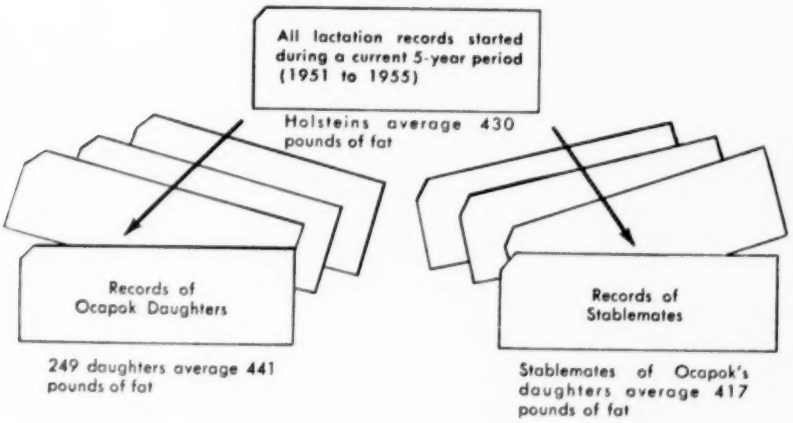
13×0.90 (page 8) = 12 pounds, which must be added to Ocapok's average. (441 + 12 = 453 pounds of fat which is the adjusted AB daughter average.) This shows that Ocapok's transmitting ability is 23 pounds of fat above the breed average, and it is the best estimate of what his daughters would have produced had they been in average herds.

Accurate evaluation requires many daughters with records

Each daughter of a sire contains a random one-half sample of his inheritance; therefore, any sire's proof based on the production of several daughters represents a sample of his inheritance. The larger the sample (number of daughters), the more accurate is the evaluation of the sire's transmitting ability.

The production records of the first few daughters of a sire may vary greatly from the breed average, but as more information is accumulated, the daughters' average will tend toward the breed average.

Figure 5


All lactation records started during a current 5-year period (1951 to 1955)
Holsteins average 430 pounds of fat
Records of Ocapok Daughters
249 daughters average 441 pounds of fat
Records of Stablemates
Stablemates of Ocapok's daughters average 417 pounds of fat

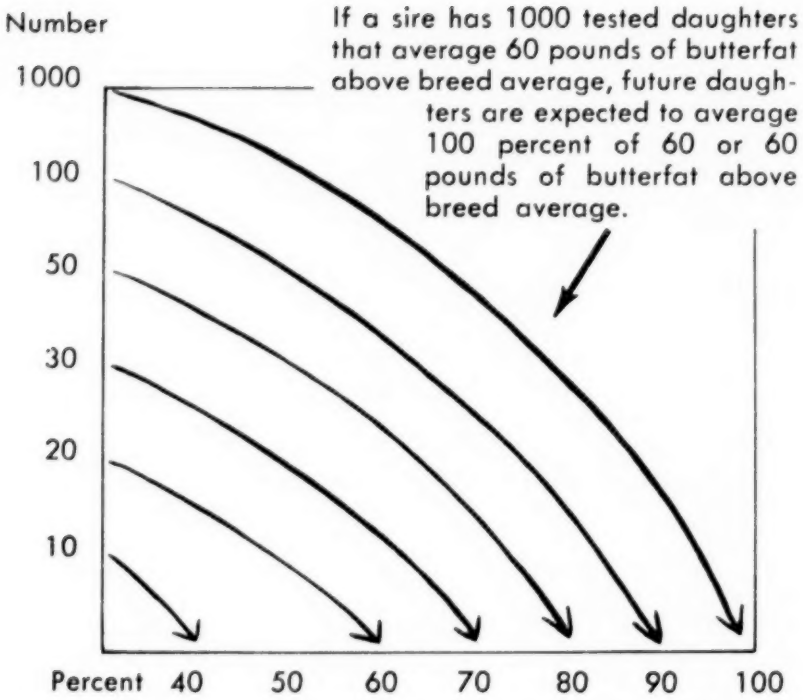

Number
1000
100
50
30
20
10
If a sire has 1000 tested daughters that average 60 pounds of butterfat above breed average, future daughters are expected to average 100 percent of 60 or 60 pounds of butterfat above breed average.
Percent 40 50 60 70 80 90 100

Figure 6. Percentage of variation from breed average of present daughters' fat production expected in the production of future daughters of the same sire.

As the number of daughters reaches 50 to 100, the expected superiority of future AB daughters is about 80 percent of his present superiority above breed average (figure 6).

How radically do natural proofs differ from AB-production information?

Sire proofs often change radically from their natural proofs to their AB proofs. The adjustments also change them, depending on when the daughters and dams made their records and on many other factors previously discussed. How three bulls were affected is given in table 3.

Why young bulls

The success of an AB production-tested sire program depends on sam-

pling many bulls and selecting the few superior ones for future AB service. Young bulls proved through AB have many years of useful service remaining after their transmitting abilities have been determined.

Research workers at Cornell have estimated that the sires selected from those sampled and tested would have daughters averaging above the daughters of all bulls tested by the amounts shown (figure 7, page 12).

Artificial insemination makes possible the selection of those bulls with the highest producing daughters for future extensive use. The sons of these bulls should also have inherited the same superiority, and therefore are the most dependable young bulls to sample.

Type and other inherited characteristics

There is no reason to believe that type conformation is inherited any differently than production is inherited. Some cows can produce and reproduce to the age of twenty years. These cows must have an inherited resistance to some diseases as well as strong bodies and udders.

Large numbers of AB daughters must be evaluated for inherited characteristics other than production to be sure the bull is acceptable from the standpoint of type.

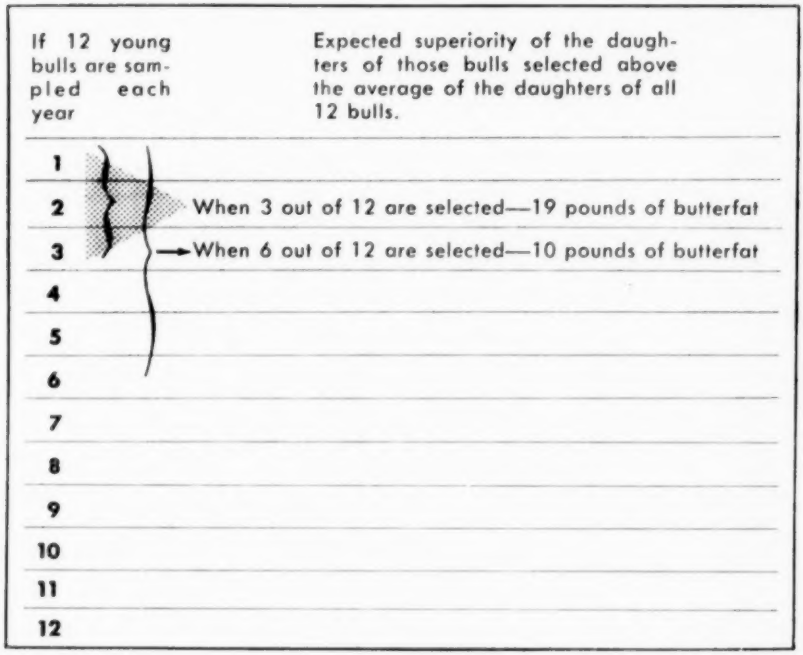
Table 3.

PAUL		OCAPOK		DEAN	
Number of Animals	Pounds of Butterfat	Number of Animals	Pounds of Butterfat	Number of Animals	Pounds of Butterfat
Natural service proof					
20 daughters	517	32 daughters	428	30 daughters	497
14 pair daughters	505	30 pair daughters	416	30 pair daughters	496
14 pair dams	419	30 pair dams	372	30 pair dams	451
Difference	+86	*Difference*	+44	*Difference*	+45
AB proof calculated by conventional daughter-dam method (2×,305,ME)					
278 daughters	423	249 daughters	441	621 daughters	472
129 pair daughters	439	129 pair daughters	454	401 pair daughters	474
129 pair dams	417	129 pair dams	412	401 pair dams	417
Difference	+22	*Difference*	+42	*Difference*	+57
AB daughter level adjusted for year, season, and herd effect and then compared to breed average *					
278 daughters	434	249 daughters	453	1071 daughters	466
Holstein Breed average	430	Holstein Breed average	430	Holstein Breed average	430
Difference	+4	*Difference*	+23	*Difference*	+36

* Breed average=2×,305-day,M.E. production average for all Holstein cows on DHI test in New York State for the past five years.

More than 11,000 cows were appraised in New York during the winter of 1954-55 to accumulate information on AB progeny as well as on non-AB cows. These data will be studied to evaluate the type characteristics that different bulls transmit as well as the relationship of type and production.

Figure 7



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